

NAVAL HEALTH RESEARCH CENTER

PREDICTORS OF NAVY ATTRITION: I. ANALYSIS OF 1-YEAR ATTRITION

*S. Booth-Kewley
G. E. Larson
M. A. K. Ryan*

Report No. 01-05

20040105 037

Approved for public release; distribution unlimited.

NAVAL HEALTH RESEARCH CENTER
P. O. BOX 85122
SAN DIEGO, CA 92186-5122

BUREAU OF MEDICINE AND SURGERY (MED-02)
2300 E ST. NW
WASHINGTON, DC 20372-5300



REPORT DOCUMENTATION PAGE

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB Control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. Report Date (DD MM YY) 08 01 01 .01		2. Report Type Interim		3. DATES COVERED (from - to) May 00 - Nov 00	
4. TITLE AND SUBTITLE Predictors of Navy Attrition I: Analysis of 1-Year Attrition				5a. Contract Number:	
6. AUTHORS Stephanie Booth-Kewley, Gerald E. Larson, Margaret A. K. Ryan				5b. Grant Number:	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Health Research Center P.O. Box 85122 San Diego, CA 92186-5122				5c. Program Element: 61153N	
8. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES) Chief, Bureau of Medicine and Surgery MED-02 2300 E St NW Washington DC 20372-5300				5d. Project Number: MR4113	
				5e. Task Number: 001	
				5f. Work Unit Number: 6904	
				9. PERFORMING ORGANIZATION REPORT NUMBER Report No. 01-05	
				10. Sponsor/Monitor's Acronyms(s) BUMED	
				11. Sponsor/Monitor's Report Number(s)	

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES
Published in Military Medicine, 2002, 67(9), 760-769

14. ABSTRACT (maximum 200 words)

First-term attrition, defined as failing to complete the contracted first enlistment term, is one of the most serious and costly problems faced by the U.S. Navy. This study was an investigation of 1-year Navy attrition in relation to demographic factors and variables assessed by the Sailors' Health Inventory Program (SHIP) questionnaire, a medical and psychosocial history questionnaire completed by all Navy recruits. Overall attrition, as well as specific categories of attrition (e.g., medical, behavioral, and administrative), were studied. The sample consisted of 66,690 Navy recruits whose status (retention vs. attrition) could be tracked to the 1-year mark. The strongest predictors of overall attrition were educational level, self-reported history of shortness of breath, ever being suspended or expelled from school, history of depression/excessive worry, fainting or dizziness, and recurrent back pain. Many other medical and psychosocial items from SHIP were also predictive of attrition. Similar factors were associated with different categories of attrition (e.g., medical, behavioral). The implications of these findings for attrition reduction strategies are discussed.

15. SUBJECT TERMS
Attrition, discharge, military, personnel selection, turnover

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UNCL	18. NUMBER OF PAGES 10	19a. NAME OF RESPONSIBLE PERSON Commanding Officer
a. REPORT UNCL	b. ABSTRACT UNCL	c. THIS PAGE UNCL			19b. TELEPHONE NUMBER (INCLUDING AREA CODE) COMM/DSN: (619) 553-8429

Predictors of Navy Attrition. I. Analysis of 1-Year Attrition

Guarantor: Stephanie Booth-Kewley, PhD

Contributors: Stephanie Booth-Kewley, PhD; Gerald E. Larson, PhD; CDR Margaret A.K. Ryan, MC USN

First-term attrition, defined as failing to complete the contracted first enlistment term, is one of the most serious and costly problems faced by the U.S. Navy. This study was an investigation of 1-year Navy attrition in relation to demographic factors and variables assessed by the Sailors' Health Inventory Program (SHIP) questionnaire, a medical and psychosocial history questionnaire completed by all Navy recruits. Overall attrition, as well as specific categories of attrition (e.g., medical, behavioral, and administrative), were studied. The sample consisted of 66,690 Navy recruits whose status (retention vs. attrition) could be tracked to the 1-year mark. The strongest predictors of overall attrition were educational level, self-reported history of shortness of breath, ever being suspended or expelled from school, history of depression/excessive worry, fainting or dizziness, and recurrent back pain. Many other medical and psychosocial items from SHIP were also predictive of attrition. Similar factors were associated with different categories of attrition (e.g., medical, behavioral). The implications of these findings for attrition reduction strategies are discussed.

Introduction

First-term attrition, defined as failing to complete the contracted first enlistment term, is one of the most serious and costly personnel problems faced by the U.S. military, including the Navy.¹ According to the General Accounting Office (GAO), in the mid-1990s, 16% of Navy recruits left the service within the first 6 months, with a total of 36% of Navy recruits discharged before the end of their first term.^{2,3} The GAO estimated that in fiscal year 1996 alone, the services lost an investment of \$390 million by recruiting and training enlistees who separated before they had completed 6 months of service.²

After the publication of the 1997 and 1998 GAO reports,^{2,3} attrition increased still further and has recently stood at historically high levels.⁴ In addition to the growing financial impact of increased attrition, early personnel losses place an increased work load and strain on the remaining staff, harming morale and readiness. Thus, the negative effects of attrition ripple throughout the armed forces, especially in times of high operational tempo. Also, because attrition creates a need for replacement personnel, it exacerbates demands on recruiters who already face difficult recruiting goals.

A primary recommendation made by the GAO^{2,3} is that the Department of Defense should improve applicant screening methods to reduce attrition. If improved screening methods could be developed, a large amount of money could be saved. It

is estimated that even a 10% reduction in attrition would produce an immediate savings of \$12 million per year.² It is imperative that the services pursue these cost savings by seeking solutions to the early attrition of first-term personnel.

A substantial number of studies have sought to identify correlates or predictors of military attrition. Most of these studies, however, have focused solely on demographic variables (e.g., age, ethnicity, or education level) or aptitude (e.g., scores on the Armed Forces Qualification Test). Surprisingly few studies have investigated a broad array of potential attrition predictors, and relatively few have examined psychological or medical factors as possible predictors of military discharge.

Past research on military attrition has generally found that education level is the single best predictor of attrition.^{1,5} Differential attrition rates by education level (e.g., high school diploma graduates vs. nongraduates) have been consistently found across services, ethnic groups, and genders.¹ Another predictor of military attrition is cognitive aptitude, measured by the Armed Services Vocational Aptitude Battery or the Armed Forces Qualification Test, a composite drawn from the Armed Services Vocational Aptitude Battery. Many studies have found that enlistees with higher aptitude scores are at reduced risk for attrition,⁶⁻⁸ although the magnitude of this association has generally been weak.

Age has also been found to be predictive of attrition, with older recruits less likely to remain in the Navy than younger recruits.^{1,8,9} Findings on gender and attrition have been mixed, with some studies finding different results depending on the type of attrition (e.g., medical vs. behavioral), some studies finding higher rates for males, some finding higher rates for females, and some finding no difference.^{1,9} Similarly, mixed results have been obtained for ethnicity and attrition, with some studies finding higher attrition for minorities and others finding higher attrition for whites.^{6,9}

Talcott and colleagues⁹ recently conducted a comprehensive evaluation of the prospective demographic and other predictors of attrition in a large population (>32,000) of individuals entering Air Force basic training, nearly 2,000 of whom were subsequently discharged. Prospective demographic predictors were age, gender, minority status, education level, and family income; other predictors included military status (active duty vs. Air Force Reserves or Air National Guard), substance use, risk taking/rebelliousness, physical activity, social support, and Air Force career plans. Talcott et al.⁹ found that low preservice physical activity and a greater history of rebelliousness were predictive of all four types of military attrition considered (medical, psychiatric/behavioral, legal, and performance attrition).

Other predictors were related to two or three types of attrition. For example, being a European American and being older were associated with medical, psychiatric/behavioral, and legal attrition but not performance attrition. A striking finding from that study was that there was only a single instance in which a

Naval Health Research Center, P.O. Box 85122, San Diego, CA 92186-5122.

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, the Department of Defense, or the U.S. Government. This research has been conducted in compliance with all applicable federal regulations governing the protection of human subjects in research.

This manuscript was received for review in May 2001. The revised manuscript was accepted for publication in February 2002.

variable predicted just one type of attrition (i.e., smoking was related to legal attrition only). The fact that other background variables predicted multiple types of attrition is important, for it suggests that individuals with certain key background characteristics (e.g., low physical activity) face many obstacles to success in the military.

The challenge for researchers is to better identify the important background factors that create an attrition risk. The current study was an attempt to explore a much broader set of potential attrition predictors than has been available in previous research. Specifically, we studied the relationship between Navy attrition and background factors assessed on the Sailors' Health Inventory Program (SHIP) questionnaire, a medical and psychosocial history questionnaire completed by all Navy recruits at the Recruit Training Command, Great Lakes.¹⁰ The SHIP questionnaire is part of a comprehensive medical information system that the Navy has developed and now maintains on all its personnel.

The objectives of this study were to determine which SHIP variables were predictive of overall attrition and which were predictive of different types of attrition (e.g., medical attrition, behavioral attrition).

Methods

Description of the SHIP Questionnaire

The SHIP questionnaire is a self-administered, optically scannable questionnaire that assesses Navy recruits' medical and psychosocial histories. Starting in fiscal year 1997, the SHIP questionnaire has been administered to all Navy recruits during inprocessing at Recruit Training Command, Great Lakes. The SHIP questionnaire is made up of a short demographic section followed by 191 items assessing medical and psychosocial variables. The vast majority of items are prefaced with the stem, "Have you had or do you have any of the following?" and are presented with a "yes/no" response format. Some sample items are "Have you had or do you have recurrent back pain?", "Have you had or do you have nervous trouble of any sort?", "Have you had or do you have leg cramps?", and "Have you had or do you have shortness of breath?"

Creation of the Database

To create a database of SHIP questionnaire responses combined with Navy performance outcome measures, an archival set of SHIP records from fiscal year 1997 to 1999 recruits was cross-referenced (using Social Security numbers) with records from another database, the Career History Archival Medical and Personnel System (CHAMPS). CHAMPS is a computerized database that combines information from Navy medical and personnel files. Status information (attrition vs. retention) and reason for discharge were extracted from CHAMPS, as was educational level. SHIP questionnaire responses, age, gender, and ethnicity were extracted from the SHIP data file.

To be retained in our sample, individuals could have no more than 20 missing SHIP responses, and information on their status at the 1-year mark (attrition vs. retention) had to be available in CHAMPS. This resulted in a sample of 66,690. A 1-year time frame was chosen for this study because more than half of all first-term attrition takes place during the first year.¹⁴

Description of the Sample

The 66,690 individuals in our sample included 23,372 individuals who had been discharged by the 1-year mark (attrites) and 43,318 individuals who were still in the Navy at least 1 year after they started their first enlistment term (survivors). The sample does not include personnel who were still in the Navy when we extracted data from the CHAMPS database but who had not yet reached 1 year of service (our criterion). Use of this strategy disproportionately collected subjects who failed early (i.e., discharged individuals are somewhat overrepresented in our sample). Because of this, the attrition rates found in this study are not generalizable to the Navy. (To understand how our strategy disproportionately collects attrites, consider the example of an arbitrary group of recruits who all begin basic training at the same time. At a 6-month follow-up, all of the individuals who attrited within 6 months would be added to the attrition sample, but no "successful nonattrites" would be added to the comparison group because the 1-yr success criterion has not yet been met. This sampling strategy should not bias the analyses because the attrition and nonattrition groups should still be representative of their respective populations.)

The sample consisted of 55,856 males (84%) and 10,834 females (16%). The race/ethnicity distribution of the sample was 59% white, 18% African American, 10% Hispanic, and 13% other (Asian, Native American, Pacific Islander, or "other"). The mean age of the sample was 19.9 years, with a standard deviation of 2.7 years. The majority of individuals in the sample were 18 to 19 years old (55.0%). These demographic characteristics are consistent with data on the entire cohort of Navy recruits completing SHIP in fiscal years 1997 to 1999.

Participants were placed into two educational categories: (1) individuals who had a high school diploma or greater (this category included individuals who had some college as well as a small proportion with college degrees), and (2) individuals without high school diplomas. The latter category was primarily made up of individuals with general equivalency diplomas, but it also included some personnel with adult education school diplomas and other alternative credentials and a small proportion with no degree. Most of the individuals in the sample (87%) were in the "high school diploma or greater" category. Thirteen percent of the overall sample did not have a high school diploma.

This pool of subjects makes up the sample for the current study and a related effort.¹¹

Discharge Status

The discharge status of each individual was determined from Department of Defense discharge codes in the CHAMPS database. Individuals who were discharged before the 1-year mark were grouped into four broad categories as a function of their official discharge codes: (1) medical discharge, (2) behavioral discharge, (3) administrative discharge, and (4) sexual behavior discharge. The medical attrition category includes individuals separated because of physical problems as well as those who failed to meet physical standards (e.g., fitness). Behavioral attrition includes substandard performance, personality disorders, drug use, alcohol abuse, fraudulent entry, and various types of misconduct, ranging from patterns of mild misconduct (such as unauthorized absences) to serious legal offenses involving civil authorities. Administrative or "convenience of the

government" attrition includes discharges for erroneous entry (e.g., failure to meet educational standards, excessive number of dependents, preservice psychological problems, criminal histories), hardship (e.g., parenthood), and other factors. Sexual behavior attrition is made up of discharges attributable to admission of homosexuality, homosexual behavior, and "sexual perversion/misconduct." Because very few individuals received a sexual behavior discharge ($n = 321$) and because individuals with this discharge code did not clearly fit into medical, behavioral, or administrative discharge categories, no further analyses were performed on this separate category, although these individuals are included in the analysis of overall attrition.

Selection of SHIP Predictors

The SHIP questionnaire contained a very large number of potential predictors of attrition (191 items, not including demographic factors). Consequently, a strategy was needed to reduce the predictors to a more manageable size. Analyses were conducted to determine the percentage of discharged personnel who endorsed each symptom or problem presented on the SHIP questionnaire. A decision rule was constructed stating that only variables endorsed by at least 5% of the discharged group would be included as potential predictors. Thirty-five medical/psychosocial items from the SHIP questionnaire met this criterion. These 35 variables, plus the 4 demographic predictors that were available (gender, ethnicity, education, and age), were used in all subsequent analyses.

Analysis

Logistic regression analysis was used to develop separate prediction models for each type of attrition: overall attrition, medical attrition, behavioral attrition, and administrative attrition. The analyses of overall attrition compared all discharged personnel in the sample ($n = 23,372$) with all personnel who remained in the Navy at the 1-year mark ($n = 43,318$). Analysis of each of the other discharge categories involved only a subset of the overall sample of 66,690. For example, in the analyses of medical attrition, all individuals who received a medical discharge ($n = 3,718$) were compared with all individuals who remained in the Navy at the 1-year mark ($n = 43,318$). In each set of analyses, the group that remained in the Navy was compared with the attrition group of interest (e.g., medical attrites, behavioral attrites).

For each category of attrition (medical, behavioral, etc.), logistic regression analyses were conducted. In the multivariate models, variables were retained using backward elimination, with criteria of $p < 0.05$ for entry and $p > 0.10$ for removal. The final multivariate models included all variables that were found to be significant as well as all of the demographic predictors.

All of the variables considered as possible predictors of attrition were treated as dichotomous variables, with the exception of age, packs or cans of tobacco per day, and frequency of alcohol use. The latter three variables were treated as continuous variables in the models. Age was measured in whole years (e.g., 18). Packs or cans of tobacco per day was measured on a four-point scale: (1) zero, (2) one, (3) two, and (4) three or more. Frequency of alcohol use was measured on a four-point scale: (1) never, (2) occasionally, (3) weekly, and (4) daily.

Results

The frequencies and percentages of individuals in each attrition category are shown in Table I. The largest category of attrition was behavioral, making up 56.6% of all discharges. The second largest attrition category was administrative (26.1% of discharges), followed by medical (15.9% of discharges). Sexual behavior represented only 1.4% of all discharges; further analyses were not conducted on this category.

Predictors of 1-Year Overall Attrition

Results of the logistic regression analysis of overall attrition are summarized in Table II. The bivariate logistic regression analysis revealed that nearly all of the variables evaluated as potential predictors were significantly associated with overall attrition ($p < 0.05$). However, because of the very large sample sizes we used in this study, significant associations do not necessarily indicate variables that have great practical importance.

In the multivariate analysis, all but six of the SHIP predictors were retained in the model. The variables that emerged as the strongest predictors of overall attrition in the multivariate analysis were less education (odds ratio [OR] = 1.87), shortness of breath (OR = 1.77), ever suspended or expelled (OR = 1.73), depression/excessive worry (OR = 1.67), fainting or dizziness (OR = 1.53), and recurrent back pain (OR = 1.52). Each of the demographic predictors (gender, ethnicity, age, and, as noted above, education) was significant in the multivariate analysis. Females were more likely than males to be discharged before the 1-year mark (OR = 1.44). Compared with whites, Hispanics were at lower risk for attrition (OR = 0.88) and African Americans were at slightly higher risk (OR = 1.08); those of other ethnicity did not differ from whites. Age had a slight positive association with overall attrition; older recruits were less likely to remain in the Navy.

Predictors of 1-Year Medical Attrition

Results of the analysis of medical attrition are presented in Table III. The bivariate analysis revealed that nearly all of the variables considered as potential predictors were significantly related to medical attrition ($p < 0.05$); the only exception was that some of the ethnic group comparisons were not significant. In the multivariate model, all of the demographic variables and all but 13 of the SHIP predictors were significant. The strongest

TABLE I
DISCHARGE INFORMATION ABOUT THE SAMPLE

	No.	Percentage of Discharged	Percentage of Total
Discharge status			
Discharge	23,372		35.0
No discharge	43,318		65.0
Total sample	66,690		
Reason for discharge			
Medical	3,718	15.9	5.6
Behavioral	13,226	56.6	19.8
Administrative	6,107	26.1	9.2
Sexual behavior	321	1.4	0.5
Total discharged	23,372		

TABLE II
ASSOCIATIONS OF SHIP ITEMS WITH OVERALL ATTRITION

Variable	Bivariate Analysis			Multivariate Analysis	
	Percent of Survivors (No.)	Percent of Attrites (No.)	OR	Adjusted OR	95% CI
Demographic variables					
Gender					
Male (reference)	84.8 (36,750)	81.7 (19,087)	1.00	1.00	
Female	15.2 (6,566)	18.3 (4,285)	1.26 ^b	1.44 ^b	1.37-1.51
Ethnicity					
White (reference)	58.1 (25,165)	60.5 (14,148)	1.00	1.00	
African American	17.4 (7,532)	17.8 (4,151)	0.98	1.08 ^b	1.03-1.13
Hispanic	11.3 (4,881)	8.9 (2,087)	0.76 ^b	0.88 ^b	0.83-0.94
Other	13.3 (5,740)	12.8 (2,986)	0.93 ^b	0.95	0.90-1.00
Education					
High school graduates (reference)	90.3 (39,001)	80.7 (18,659)	1.00	1.00	
Non-high-school graduates	9.7 (4,173)	19.3 (4,469)	2.24 ^b	1.87 ^b	1.78-1.97
Age ^a			1.02 ^b	1.03 ^b	1.02-1.03
Physical health variables					
Sinus problems/sinusitis	5.5 (2,389)	10.5 (2,440)	2.00 ^b	1.13 ^b	1.05-1.21
Ear, nose, or throat trouble	3.0 (1,283)	6.2 (1,451)	2.17 ^b	1.09	1.00-1.20
Lost consciousness for any reason	2.1 (926)	5.0 (1,176)	2.43 ^b	-	-
Cold sores	4.8 (2,070)	8.1 (1,894)	1.76 ^b	1.15 ^b	1.07-1.24
Hay fever	3.8 (1,648)	5.5 (1,292)	1.48 ^b	-	-
Pain or pressure in chest	1.6 (673)	6.1 (1,418)	4.09 ^b	1.42 ^b	1.26-1.61
Leg cramps	2.5 (1,085)	6.8 (1,576)	2.82 ^b	1.12 ^b	1.01-1.24
Recurrent back pain	1.7 (742)	6.0 (1,398)	3.65 ^b	1.52 ^b	1.35-1.70
History of broken bones	10.5 (4,428)	18.6 (4,192)	1.95 ^b	1.45 ^b	1.38-1.53
Motion sickness	4.3 (1,851)	7.0 (1,631)	1.68 ^b	-	-
Allergies	12.9 (5,575)	18.8 (4,387)	1.57 ^b	1.20 ^b	1.14-1.26
Hives	4.5 (1,955)	6.8 (1,568)	1.53 ^b	-	-
Skin condition	5.8 (2,492)	8.2 (1,910)	1.46 ^b	-	-
Shortness of breath	1.2 (513)	5.2 (1,225)	4.62 ^b	1.77 ^b	1.55-2.02
Fainting or dizziness in the past 12 months not caused by exercise, heat, or standing up quickly	1.3 (555)	5.1 (1,180)	4.10 ^b	1.53 ^b	1.35-1.74
Recent gain or loss of weight	3.9 (1,681)	6.0 (1,406)	1.59 ^b	0.91	0.84-1.00
Ever in hospital overnight	11.9 (5,153)	20.1 (4,667)	1.85 ^b	1.32 ^b	1.25-1.39
Psychosocial variables					
Frequent trouble sleeping	2.9 (1,237)	8.1 (1,878)	2.98 ^b	-	-
Depression/excessive worry	2.4 (1,034)	9.5 (2,221)	4.30 ^b	1.67 ^b	1.50-1.85
Past counseling for problems	2.1 (902)	5.4 (1,259)	2.68 ^b	1.17 ^b	1.05-1.30
Nervous trouble of any sort	1.6 (682)	5.1 (1,193)	3.37 ^b	1.25 ^b	1.11-1.42
Extended periods of disturbed sleep, appetite, or concentration	2.1 (928)	7.8 (1,821)	3.86 ^b	1.32 ^b	1.19-1.47
Extended periods of depression or anxiety	1.3 (565)	6.3 (1,462)	5.05 ^b	1.25 ^b	1.09-1.43
History of physical, emotional, or sexual abuse	2.3 (987)	5.3 (1,242)	2.41 ^b	1.32 ^b	1.19-1.46
History of learning disability	3.8 (1,631)	7.5 (1,755)	2.08 ^b	1.13 ^b	1.04-1.23
Problems getting along with teachers, job supervisors, etc.	3.3 (1,439)	8.4 (1,953)	2.65 ^b	1.21 ^b	1.11-1.32
Ever in special education classes	4.7 (2,042)	6.9 (1,615)	1.50 ^b	1.10 ^b	1.01-1.19
Ever arrested for a crime	2.6 (1,108)	5.7 (1,328)	2.30 ^b	1.44 ^b	1.31-1.59
Ever suspended or expelled	10.2 (4,421)	23.9 (5,583)	2.77 ^b	1.73 ^b	1.65-1.83
Impulsive, act without thinking about it	3.5 (1,513)	9.4 (2,184)	2.85 ^b	1.31 ^b	1.21-1.42
Ever deliberately cut, burn, or tattooed yourself	4.2 (1,817)	9.9 (2,299)	2.49 ^b	1.32 ^b	1.23-1.43
Ever stolen, set fires, killed animals, fought with weapons, run away from home, or vandalized property	4.4 (1,922)	10.5 (2,460)	2.53 ^b	1.23 ^b	1.14-1.33
Smoking	19.4 (8,405)	36.3 (8,489)	2.37 ^b	1.35 ^b	1.26-1.44
Packs or cans of tobacco per day ^a			2.06 ^b	1.29 ^b	1.22-1.37
Frequency of alcohol use ^a			1.36 ^b	1.07 ^b	1.01-1.10

For the bivariate analysis, *n* values range from 64,715 to 66,690. *N* = 61,353 for the multivariate analysis. OR, odds ratio; CI, confidence interval.

^a Nondichotomous variable.

^b *p* < 0.05.

^c -, Variable was not retained in the final model because it was not statistically significant.

TABLE III
ASSOCIATIONS OF SHIP ITEMS WITH MEDICAL ATTRITION

Variable	Bivariate Analysis			Multivariate Analysis	
	Percent of Survivors (No.)	Percent of Attrites (No.)	OR	Adjusted OR	95% CI
Demographic variables					
Gender					
Male (reference)	84.8 (36,750)	74.2 (2,757)	1.00	1.00	
Female	15.2 (6,566)	25.8 (961)	1.95 ^b	2.16 ^b	1.98-2.35
Ethnicity					
White (reference)	58.1 (25,165)	60.7 (2,256)	1.00	1.00	
African American	17.4 (7,532)	17.8 (661)	0.98	0.98	0.89-1.09
Hispanic	11.3 (4,881)	8.1 (303)	0.69 ^b	0.81 ^b	0.71-0.93
Other	13.3 (5,740)	13.4 (498)	0.97	1.00	0.90-1.12
Education					
High school graduates (reference)	90.3 (39,001)	84.2 (3,099)	1.00	1.00	
Non-high-school graduates	9.7 (4,173)	15.8 (583)	1.76 ^b	1.58 ^b	1.42-1.75
Age ^a			1.04 ^b	1.05 ^b	1.04-1.07
Physical health variables					
Sinus problems/sinusitis	5.5 (2,389)	12.9 (479)	2.54 ^b	1.34 ^b	1.18-1.52
Ear, nose, or throat trouble	3.0 (1,283)	6.8 (252)	2.38 ^b	- ^c	-
Lost consciousness for any reason	2.1 (926)	5.8 (214)	2.80 ^b	1.19	0.99-1.44
Cold sores	4.8 (2,070)	9.6 (356)	2.11 ^b	1.29 ^b	1.13-1.49
Hay fever	3.8 (1,648)	6.4 (238)	1.73 ^b	-	-
Pain or pressure in chest	1.6 (673)	7.4 (275)	5.06 ^b	1.53 ^b	1.26-1.87
Leg cramps	2.5 (1,085)	7.9 (292)	3.32 ^b	-	-
Recurrent back pain	1.7 (742)	7.3 (273)	4.55 ^b	1.81 ^b	1.51-2.18
History of broken bones	10.5 (4,428)	21.8 (778)	2.37 ^b	1.76 ^b	1.60-1.94
Motion sickness	4.3 (1,851)	7.6 (282)	1.84 ^b	-	-
Allergies	12.9 (5,575)	23.2 (862)	2.04 ^b	1.43 ^b	1.30-1.57
Hives	4.5 (1,955)	8.5 (313)	1.94 ^b	-	-
Skin condition	5.8 (2,492)	9.1 (339)	1.64 ^b	1.17 ^b	1.02-1.34
Shortness of breath	1.2 (513)	7.3 (272)	6.59 ^b	2.49 ^b	2.04-3.04
Fainting or dizziness in the past 12 months not caused by exercise, heat, or standing up quickly	1.3 (555)	5.9 (220)	4.83 ^b	1.54 ^b	1.24-1.90
Recent gain or loss of weight	3.9 (1,681)	6.7 (249)	1.78 ^b	-	-
Ever in hospital overnight	11.9 (5,153)	26.7 (987)	2.68 ^b	1.91 ^b	1.74-2.08
Psychosocial variables					
Frequent trouble sleeping	2.9 (1,237)	8.0 (298)	2.97 ^b	-	-
Depression/excessive worry	2.4 (1,034)	9.0 (335)	4.05 ^b	1.45 ^b	1.22-1.73
Past counseling for problems	2.1 (902)	4.1 (151)	1.99 ^b	0.80 ^b	0.65-0.99
Nervous trouble of any sort	1.6 (682)	5.1 (189)	3.35 ^b	1.28 ^b	1.03-1.58
Extended periods of disturbed sleep, appetite, or concentration	2.1 (928)	8.0 (296)	3.95 ^b	1.38 ^b	1.15-1.65
Extended periods of depression or anxiety	1.3 (565)	5.9 (219)	4.73 ^b	-	-
History of physical, emotional, or sexual abuse	2.3 (987)	5.1 (190)	2.31 ^b	-	-
History of learning disability	3.8 (1,631)	6.6 (247)	1.82 ^b	-	-
Problems getting along with teachers, job supervisors, etc.	3.3 (1,439)	7.4 (275)	2.32 ^b	1.16	0.99-1.37
Ever in special education classes	4.7 (2,042)	7.8 (290)	1.71 ^b	1.33 ^b	1.15-1.54
Ever arrested for a crime	2.6 (1,108)	3.9 (143)	1.53 ^b	-	-
Ever suspended or expelled	10.2 (4,421)	20.3 (752)	2.23 ^b	1.53 ^b	1.38-1.70
Impulsive, act without thinking about it	3.5 (1,513)	8.7 (322)	2.63 ^b	1.27 ^b	1.09-1.48
Ever deliberately cut, burn, or tattooed yourself	4.2 (1,817)	6.9% (257)	1.70 ^b	-	-
Ever stolen, set fires, killed animals, fought with weapons, run away from home, or vandalized property	4.4 (1,922)	9.8 (363)	2.33 ^b	1.31 ^b	1.14-1.51
Smoking	19.4 (8,405)	31.9 (1,185)	1.94 ^b	1.15	0.99-1.32
Packs or cans of tobacco per day ^a			1.79 ^b	1.26 ^b	1.13-1.40
Frequency of alcohol use ^a			1.24 ^b	-	-

For the bivariate analysis, *n* values range from 45,769 to 47,036. *N* = 44,430 for the multivariate analysis. OR, odds ratio; CI, confidence interval.

^a Nondichotomous variable.

^b *p* < 0.05.

^c -, Variable was not retained in the final model because it was not statistically significant.

predictors of medical attrition in the multivariate analysis were (in this order) shortness of breath (OR = 2.49), female gender (OR = 2.16), ever in the hospital overnight (OR = 1.91), recurrent back pain (OR = 1.81), history of broken bones (OR = 1.76), and less education (OR = 1.58). Ethnicity and age were also significant: Hispanics were significantly less likely than whites to receive a medical discharge (OR = 0.81), but none of the other ethnic group comparisons were significant. There was a slight positive association between medical attrition and the continuous variable of age, indicating that older individuals were at slightly higher risk for medical attrition.

It is apparent from Table III that although the strongest bivariate predictors of medical attrition were either physical symptom variables or demographic factors, many of the variables found to be significant in the multivariate analysis were psychosocial items, such as depression/excessive worry, being suspended or expelled, and extended periods of disturbed sleep, appetite, or concentration.

Predictors of 1-Year Behavioral Attrition

In the analysis of behavioral attrition, all of the variables considered as potential predictors (both demographic variables and SHIP items) were found to be significant ($p < 0.05$; Table IV). In the multivariate analysis, all of the demographic variables except for gender and all but 13 of the SHIP predictors remained significant. The strongest predictors of behavioral attrition in the multivariate analysis were less education (OR = 2.04), ever suspended or expelled (OR = 1.81), ever arrested for a crime (OR = 1.74), being a smoker (OR = 1.50), depression/excessive worry (OR = 1.49), and shortness of breath (OR = 1.49). Each of the other demographic predictors (gender, ethnicity, and age) was also associated with behavioral attrition. Compared with whites, African Americans were at higher risk for behavioral attrition (OR = 1.21), and Hispanics (OR = 0.92) and those of other ethnicity (OR = 0.93) were at slightly lower risk. As in the other analyses, a modest but significant positive association was found between behavioral attrition and age.

Although a number of the physical symptom items from SHIP (e.g., shortness of breath, recurrent back pain, and history of broken bones) had significant associations with behavioral attrition, in general, the variables with the strongest links with this outcome were psychosocial items (e.g., ever suspended or expelled, ever arrested for a crime, depression/excessive worry, and being a smoker).

Predictors of 1-Year Administrative Attrition

In the bivariate analysis, all but one of the potential predictors of administrative attrition (age) was significant (Table V). In the multivariate analysis, all of the demographic variables and all but nine of the SHIP predictors were significant. The strongest predictors of administrative attrition in the multivariate analysis were depression/excessive worry (OR = 2.12), female gender (OR = 2.10), shortness of breath (OR = 1.76), fainting or dizziness (OR = 1.76), ever suspended or expelled (OR = 1.71), and pain or pressure in chest (OR = 1.65). Ethnicity, education, and age were also significantly associated with administrative attrition. Compared with whites, both African Americans (OR = 0.85) and Hispanics (OR = 0.81) were at lower risk for administrative discharge, whereas those of other ethnicity had essen-

tially the same risk as whites. Compared with high school graduates, nongraduates were at significantly higher risk for administrative attrition (OR = 1.65). As observed for the other types of attrition, a slight positive association between age and administrative attrition was found.

Summary of Attrition Predictors

The best predictors of each type of Navy attrition are shown in Table VI. The predictors are listed in order of the size of their adjusted association with each type of attrition. For example, education was the strongest predictor of overall attrition, so it is listed first in the "Overall Attrition" column. Note that there is overlap in the data used for the analysis of overall attrition vs. the specific categories of attrition.

The most striking finding apparent from Table VI is that similar variables were robust predictors across different categories of attrition. For example, less education, shortness of breath, history of broken bones, depression/excessive worry, and ever suspended or expelled from school emerged as the best predictors for all attrition categories. Similarly, gender (female), pain or pressure in chest, and fainting or dizziness were among the best predictors of both medical and administrative attrition. Recurrent back pain was one of the best predictors of both medical and behavioral attrition.

Discussion

This was an exploratory study designed to identify predictors of 1-year attrition in a large sample of Navy recruits. Numerous variables were examined as potential predictors of Navy attrition, including demographic variables and items from SHIP, a medical and psychosocial history questionnaire that is completed by all Navy recruits at Recruit Training Command, Great Lakes. Four categories of attrition were examined: overall, medical, behavioral, and administrative attrition.

The results of this study showed that the strongest predictors of overall attrition were educational status and the following SHIP items: history of shortness of breath, ever being suspended or expelled from school, history of depression/excessive worry, fainting or dizziness, and recurrent back pain. Adjusting for all other predictors of attrition, these variables still had OR values that exceeded 1.5. Many other medical and psychosocial items from SHIP were also significant predictors of overall attrition (e.g., ever arrested for a crime and being a smoker), but the adjusted OR values for most of these other items were more modest (< 1.5).

An important finding of this study is that similar predictors were associated with different types of attrition. Education, for example, emerged as one of the strongest predictors of medical and behavioral attrition. Similarly, having been suspended or expelled from school emerged as one of the best predictors of behavioral and administrative attrition. Shortness of breath, surprisingly, was one of the best predictors of all types of attrition. In the bivariate analyses, 39 variables were significantly predictive of both medical and behavioral attrition, 37 were predictive of both medical and administrative attrition, and 37 were predictive of both behavioral and administrative attrition. The fact that the same predictors were associated with different

TABLE IV
ASSOCIATIONS OF SHIP ITEMS WITH BEHAVIORAL ATTRITION

Variable	Bivariate Analysis			Multivariate Analysis	
	Percent of Survivors (No.)	Percent of Attrites (No.)	OR	Adjusted OR	95% CI
Demographic variables					
Gender					
Male (reference)	84.8 (36,750)	87.8 (14,927)	1.00	1.00	
Female	15.2 (6,566)	12.2 (2,066)	0.82 ^b	0.99	0.93-1.06
Ethnicity					
White (reference)	58.1 (25,165)	59.6 (10,126)	1.00	1.00	
African American	17.4 (7,532)	19.4 (3,301)	1.05	1.21 ^b	1.14-1.29
Hispanic	11.3 (4,881)	9.2 (1,566)	0.79 ^b	0.92 ^b	0.85-0.99
Other	13.3 (5,740)	11.8 (2,000)	0.90 ^b	0.93 ^b	0.87-0.99
Education					
High school graduates (reference)	90.3 (39,001)	78.6 (13,231)	1.00	1.00	
Non-high-school graduates	9.7 (4,173)	21.4 (3,593)	2.60 ^b	2.04 ^b	1.92-2.16
Age ^a			1.01 ^b	1.01 ^b	1.01-1.02
Physical health variables					
Sinus problems/sinusitis	5.5 (2,389)	8.5 (1,440)	1.68 ^b	- ^c	-
Ear, nose, or throat trouble	3.0 (1,283)	5.1 (860)	1.90 ^b	1.11	0.99-1.25
Lost consciousness for any reason	2.1 (926)	4.2 (711)	2.15 ^b	-	-
Cold sores	4.8 (2,070)	6.5 (1,102)	1.49 ^b	-	-
Hay fever	3.8 (1,648)	4.6 (789)	1.33 ^b	-	-
Pain or pressure in chest	1.6 (673)	4.3 (734)	3.15 ^b	1.29 ^b	1.11-1.49
Leg cramps	2.5 (1,085)	5.3 (899)	2.40 ^b	-	-
Recurrent back pain	1.7 (742)	4.4 (740)	3.02 ^b	1.39 ^b	1.21-1.59
History of broken bones	10.5 (4,428)	16.2 (2,652)	1.80 ^b	1.35 ^b	1.27-1.44
Motion sickness	4.3 (1,851)	5.6 (949)	1.44 ^b	-	-
Allergies	12.9 (5,575)	16.1 (2,729)	1.35 ^b	1.12 ^b	1.05-1.19
Hives	4.5 (1,955)	5.6 (949)	1.33 ^b	-	-
Skin condition	5.8 (2,492)	7.4 (1,250)	1.37 ^b	-	-
Shortness of breath	1.2 (513)	3.6 (618)	3.53 ^b	1.49 ^b	1.27-1.74
Fainting or dizziness in the past 12 months not caused by exercise, heat, or standing up quickly	1.3 (555)	3.4 (581)	3.11 ^b	1.29 ^b	1.10-1.50
Recent gain or loss of weight	3.9 (1,681)	5.4 (907)	1.47 ^b	-	-
Ever in hospital overnight	11.9 (5,153)	16.6 (2,795)	1.55 ^b	1.11 ^b	1.04-1.18
Psychosocial variables					
Frequent trouble sleeping	2.9 (1,237)	6.4 (1,091)	2.58 ^b	-	-
Depression/excessive worry	2.4 (1,034)	6.9 (1,174)	3.49 ^b	1.49 ^b	1.31-1.69
Past counseling for problems	2.1 (902)	4.4 (751)	2.32 ^b	-	-
Nervous trouble of any sort	1.6 (682)	3.9 (665)	2.85 ^b	1.16 ^b	1.01-1.35
Extended periods of disturbed sleep, appetite, or concentration	2.1 (928)	5.8 (992)	3.23 ^b	1.30 ^b	1.15-1.48
Extended periods of depression or anxiety	1.3 (565)	4.5 (767)	4.17 ^b	1.24 ^b	1.05-1.46
History of physical, emotional, or sexual abuse	2.3 (987)	3.9 (668)	1.91 ^b	1.34 ^b	1.19-1.52
History of learning disability	3.8 (1,631)	6.1 (1,037)	1.75 ^b	-	-
Problems getting along with teachers, job supervisors, etc.	3.3 (1,439)	7.9 (1,333)	2.66 ^b	1.26 ^b	1.14-1.40
Ever in special education classes	4.7 (2,042)	5.6 (946)	1.24 ^b	-	-
Ever arrested for a crime	2.6 (1,108)	6.6 (1,123)	2.90 ^b	1.74 ^b	1.56-1.93
Ever suspended or expelled	10.2 (4,421)	24.6 (4,171)	3.11 ^b	1.81 ^b	1.70-1.92
Impulsive, act without thinking about it	3.5 (1,513)	8.3 (1,398)	2.69 ^b	1.23 ^b	1.12-1.36
Ever deliberately cut, burn, or tattooed yourself	4.2 (1,817)	10.0 (1,696)	2.80 ^b	1.44 ^b	1.32-1.57
Ever stolen, set fires, killed animals, fought with weapons, run away from home, or vandalized property	4.4 (1,922)	10.4 (1,756)	2.71 ^b	1.29 ^b	1.19-1.41
Smoking	19.4 (8,405)	38.7 (6,579)	2.81 ^b	1.50 ^b	1.39-1.62
Packs or cans of tobacco per day ^a			2.30 ^b	1.32 ^b	1.24-1.41
Frequency of alcohol use ^a			1.59 ^b	1.22 ^b	1.17-1.26

Because of missing data, *n* values for the bivariate analysis range from 58,578 to 60,311. *N* = 52,619 for the multivariate analysis. OR, odds ratio; CI, confidence interval.

^a Nondichotomous variable.

^b *p* < 0.05.

^c -, Variable was not retained in the final model because it was not statistically significant.

TABLE V
ASSOCIATIONS OF SHIP ITEMS WITH ADMINISTRATIVE ATTRITION

Variable	Bivariate Analysis		Multivariate Analysis		
	Percent of Survivors (No.)	Percent of Attrites (No.)	OR	Adjusted OR	95% CI
Demographic variables					
Gender					
Male (reference)	84.5 (36,750)	74.5 (4,548)	1.00	1.00	
Female	15.2 (6,566)	25.5 (1,559)	1.92 ^b	2.10 ^b	1.96-2.26
Ethnicity					
White (reference)	58.1 (25,165)	62.1 (3,793)	1.00	1.00	
African American	17.4 (7,532)	15.7 (960)	0.85 ^b	0.85 ^b	0.78-0.93
Hispanic	11.3 (4,881)	8.7 (534)	0.73 ^b	0.81 ^b	0.73-0.90
Other	13.3 (5,740)	13.4 (820)	0.95	0.96	0.88-1.05
Education					
High school graduates (reference)	90.3 (39,001)	83.5 (5,045)	1.00	1.00	
Non-high-school graduates	9.7 (4,173)	16.5 (997)	1.85 ^b	1.65 ^b	1.51-1.79
Age ^a			1.01	1.03 ^b	1.02-1.04
Physical health variables					
Sinus problems/sinusitis	5.5 (2,389)	12.4 (753)	2.41 ^b	1.19 ^b	1.07-1.33
Ear, nose, or throat trouble	3.0 (1,283)	7.5 (459)	2.66 ^b	- ^c	-
Lost consciousness for any reason	2.1 (926)	5.8 (356)	2.84 ^b	-	-
Cold sores	4.8 (2,070)	9.8 (596)	2.16 ^b	1.28 ^b	1.14-1.44
Hay fever	3.8 (1,648)	6.2 (378)	1.67 ^b	-	-
Pain or pressure in chest	1.6 (673)	8.3 (508)	5.75 ^b	1.65 ^b	1.39-1.94
Leg cramps	2.5 (1,085)	8.3 (508)	3.54 ^b	1.17 ^b	1.01-1.36
Recurrent back pain	1.7 (742)	7.4 (452)	4.59 ^b	1.47 ^b	1.24-1.73
History of broken bones	10.5 (4,428)	19.3 (1,136)	2.04 ^b	1.51 ^b	1.39-1.64
Motion sickness	4.3 (1,851)	8.8 (535)	2.15 ^b	-	-
Allergies	12.9 (5,575)	20.8 (1,264)	1.77 ^b	1.25 ^b	1.16-1.36
Hives	4.5 (1,955)	7.4 (451)	1.69 ^b	-	-
Skin condition	5.8 (2,492)	8.7 (526)	1.55 ^b	-	-
Shortness of breath	1.2 (513)	6.7 (408)	5.97 ^b	1.76 ^b	1.46-2.11
Fainting or dizziness in the past 12 months not caused by exercise, heat, or standing up quickly	1.3 (555)	7.1 (430)	5.85 ^b	1.76 ^b	1.48-2.09
Recent gain or loss of weight	3.9 (1,681)	6.5 (394)	1.71 ^b	0.82 ^b	0.71-0.95
Ever in hospital overnight	11.9 (5,153)	22.2 (1,352)	2.11 ^b	1.45 ^b	1.34-1.57
Psychosocial variables					
Frequent trouble sleeping	2.9 (1,237)	10.3 (628)	3.90 ^b	-	-
Depression/excessive worry	2.4 (1,034)	13.5 (824)	6.39 ^b	2.12 ^b	1.83-2.44
Past counseling for problems	2.1 (902)	7.8 (474)	3.96 ^b	1.51 ^b	1.30-1.75
Nervous trouble of any sort	1.6 (682)	6.8 (415)	4.56 ^b	1.31 ^b	1.10-1.56
Extended periods of disturbed sleep, appetite, or concentration	2.1 (928)	10.4 (633)	5.29 ^b	1.35 ^b	1.16-1.57
Extended periods of depression or anxiety	1.3 (565)	8.8 (539)	7.33 ^b	1.31 ^b	1.09-1.58
History of physical, emotional, or sexual abuse	2.3 (987)	7.7 (467)	3.55 ^b	1.43 ^b	1.24-1.65
History of learning disability	3.8 (1,631)	10.5 (643)	3.01 ^b	1.52 ^b	1.34-1.71
Problems getting along with teachers, job supervisors, etc.	3.3 (1,439)	9.1 (554)	2.91 ^b	1.19 ^b	1.04-1.36
Ever in special education classes	4.7 (2,042)	8.8 (536)	1.95 ^b	1.27 ^b	1.12-1.43
Ever arrested for a crime	2.6 (1,108)	4.0 (245)	1.59 ^b	-	-
Ever suspended or expelled	10.2 (4,421)	21.9 (1,338)	2.47 ^b	1.71 ^b	1.57-1.86
Impulsive, act without thinking about it	3.5 (1,513)	11.1 (674)	3.43 ^b	1.49 ^b	1.32-1.69
Ever deliberately cut, burn, or tattooed yourself	4.2 (1,817)	9.5 (580)	2.40 ^b	1.25 ^b	1.11-1.41
Ever stolen, set fires, killed animals, fought with weapons, run away from home, or vandalized property	4.4 (1,922)	9.8 (597)	2.33 ^b	-	-
Smoking	19.4 (8,405)	30.7 (1,876)	1.84 ^b	1.13 ^b	1.01-1.27
Packs or cans of tobacco per day ^a			1.74 ^b	1.24 ^b	1.13-1.37
Frequency of alcohol use ^a			1.04	0.82 ^b	0.78-0.86

Because of missing data, *n* values for the bivariate analysis range from 48,428 to 49,425. *N* = 45,932 for the multivariate analysis. OR, odds ratio; CI, confidence interval.

^a Nondichotomous variable.

^b *p* < 0.05.

^c -, Variable was not retained in the final model because it was not statistically significant.

TABLE VI
BEST PREDICTORS OF NAVY ATTRITION IN DESCENDING ORDER OF PREDICTIVE STRENGTH

Overall Attrition	Medical Attrition	Behavioral Attrition	Administrative Attrition
1. Education (less)	Shortness of breath	Education (less)	Depression/excessive worry
2. Shortness of breath	Gender (female)	Ever suspended or expelled	Gender (female)
3. Ever suspended or expelled	Ever in hospital overnight	Ever arrested for a crime	Shortness of breath
4. Depression/excessive worry	Recurrent back pain	Smoking	Fainting or dizziness ^a
5. Fainting or dizziness ^a	History of broken bones	Depression/excessive worry	Ever suspended or expelled
6. Recurrent back pain	Education (less)	Shortness of breath	Pain or pressure in chest
7. History of broken bones	Fainting or dizziness ^a	Ever deliberately cut, burn, or tattoo	Education (less)
8. Ever arrested for a crime	Pain or pressure in chest	Recurrent back pain	History of learning disability
9. Gender (female)	Ever suspended or expelled	History of broken bones	Impulsive, act without thinking about it
10. Pain or pressure in chest	Depression/excessive worry	History of abuse ^b	History of broken bones

^a Fainting or dizziness in the past 12 months not caused by exercise, heat, or standing up quickly.

^b History of physical, emotional, or sexual abuse.

categories of attrition is consistent with results obtained by Talcott et al. in a study of attrition in a large sample of Air Force recruits.⁹

Also consistent with the results of Talcott et al.,⁹ gender was a fairly important predictor of 1-year attrition. Women were at increased risk for overall attrition as well as for medical and administrative attrition. However, for behavioral attrition, the risk for discharge was the same for both genders. Some associations were also found between ethnicity and attrition. The most important finding was that Hispanics were at significantly reduced risk for overall attrition compared with whites. These results are similar to those of Talcott et al.,⁹ although they also found that other minority groups (e.g., black, other) were at significantly reduced risk for overall attrition compared with whites. It is possible that Hispanics have different motivations for entering the Navy than whites and are more likely to regard the military as a career path than as a temporary job.

Education level emerged as a very important predictor of attrition. Individuals who had not graduated from high school (i.e., those with general equivalency diplomas or less) were at increased risk for overall attrition, medical attrition, administrative attrition, and especially behavioral attrition. Nongraduates were approximately twice as likely to be discharged for behavioral reasons than those who had graduated from high school. In fact, education emerged as one of the strongest predictors of discharge. These findings are consistent with past research on attrition predictors,^{1,9,12} and highlight the challenges associated with the military's recent policy to allow more non-high school graduates to enlist.⁴

One possible reason for our overall finding of similar predictors across attrition categories concerns problems with overlap and ambiguity of the discharge codes. The GAO concluded that separation codes are often used by each of the services in an inconsistent and subjective manner.³ For example, an individual separated for medical problems might be categorized either as a medical discharge or as an administrative discharge (erroneous enlistment), particularly if it was believed that the mem-

ber concealed his or her medical problem at the time of enlistment. According to the GAO,² this may be a fairly common occurrence.

The GAO's conclusions regarding inconsistencies in separation codes agree with other work, such as a RAND study¹³ that compared the separation codes assigned to military personnel with information drawn from their personnel folders. The RAND authors reported that 80% of the separated personnel had multiple reasons for discharge (e.g., misconduct, medical, and job performance), any of which could have been chosen as the official reason. Thus, officially assigned separation codes may be chosen because they represent the most defensible justification for discharge, because they reflect less adversely on the command or the individual, because they are most administratively convenient, or arbitrarily, in the sense there are multiple reasons for the discharge but a single code has to be chosen for the record. If the attrition categories are not conceptually distinct, it makes sense that similar predictors would be associated with different categories.

One interesting result of this study concerns tobacco use. Two SHIP variables relating to tobacco use were considered as predictors of attrition: identifying oneself as a smoker and number of packs or cans of tobacco used per day. Even with all other SHIP variables adjusted for, smokers were at increased risk for overall attrition, behavioral attrition, and administrative attrition (but not medical attrition). In addition, the quantity of tobacco consumed per day was associated with overall, medical, behavioral, and administrative attrition. These results are similar to the findings of Snoddy and Henderson, who found that smokers were less likely than nonsmokers to complete Army basic infantry training.¹⁴ It is unclear whether tobacco use contributes directly to attrition or whether tobacco use is a marker for other traits (e.g., rebelliousness, past delinquency) that place individuals at risk for discharge. Further research is needed to gain a better understanding of this tobacco use-attrition association.

Another intriguing result of this study concerns the symptom shortness of breath.¹¹ Individuals who indicated on the SHIP

questionnaire that they had experienced this symptom were at significantly greater risk for overall, medical, behavioral, and administrative attrition than those who did not. For all types of attrition, a history of shortness of breath was one of the strongest predictors. This result may have occurred because shortness of breath can be a symptom of both asthma and anxiety disorders.^{15,16} It is possible that both of these conditions link shortness of breath to attrition. Again, additional research is needed to gain a better understanding of these issues.

It is possible that the associations we found between SHIP items and attrition are underestimates of the true effect sizes. Given the fact that recruits completed the SHIP questionnaires during their early days in basic training, they may have felt inhibited about revealing negative information about themselves, leading to underreporting of medical and psychosocial problems. The SHIP questionnaires were not anonymous, which also may have made participants reluctant to acknowledge problems and symptoms.

Some limitations of the present study should be acknowledged. First, a very large number of variables were considered in these analyses, making it likely that a number of the significant findings were attributable to chance alone. Second, most of the variables in the study (all of those obtained from the SHIP questionnaire) were binary (yes/no items) rather than continuous in nature. Psychometrically, it would have been preferable to have attrition predictors that were continuously distributed. Also, some of the variables considered as attrition predictors in the present study were moderately correlated with each other (e.g., the problem of collinearity), which may have led to statistical bias in some of the results presented here. Finally, the criterion variables used in this study (the various categories of attrition) are not truly distinct and independent, nor should they be regarded as truly objective variables. The discharge code received by any individual leaving the Navy is likely a reflection of both that person's behavior and life situation and an administrative decision.

In light of our results showing great similarity of predictors across discharge categories, attrition may be easier to model than once thought. A small number of broadly important risk factors for attrition have been identified here. These risk factors need to be better defined, and instruments capable of reliably measuring these factors need to be developed and tested. Although the full array of characteristics that should be assessed by these instruments is not clear at this time, our study indicates the potential importance of depression and anxiety, juvenile misconduct, various physical and psychosomatic complaints, and failure to graduate from high school. Previous research has linked similar characteristics to attrition, such as "stress reactivity"⁸ and negative affectivity.¹² Clearly, additional work is needed to more fully outline the characteristics that put recruits at risk for attrition.

Although many investigations of military attrition have been conducted, the present effort remains one of the largest studies of prospective predictors of attrition ever performed. This study was also unique in that a broad range of potential attrition predictors were evaluated, including medical and psychological factors, and different categories of attrition were examined. This effort can also be used to generate a number of different hypotheses (e.g., smoking and shortness of breath in relation to attrition) that can be explored in future investigations of military attrition.

Acknowledgments

We gratefully acknowledge the assistance of Milan Miller during the construction of the database. This report was supported by the Office of Naval Research under Work Unit No. 61153N.MR4113-6904.

References

1. Laurence JH, Naughton J, Harris DA: Attrition Revisited: Identifying the Problem and Its Solutions. ARI Research Note 96-20. Alexandria, VA, Army Research Institute, 1996.
2. Military Attrition: DoD Could Save Millions by Better Screening Enlisted Personnel. GAO/NSIAD-97-39. Washington, DC, General Accounting Office, January 1997.
3. Military Attrition: DoD Needs to Better Analyze Reasons for Separation and Improve Recruiting Systems. GAO/T-NSIAD-98-117. Washington, DC, General Accounting Office, March 1998.
4. Military Personnel: Services Need to Assess Efforts to Meet Recruiting Goals and Cut Attrition. GAO/NSIAD-00-146. Washington, DC, General Accounting Office, June 2000.
5. Elster RS, Flyer ES: A Study of Relationships between Educational Credentials and Military Performance Criteria. Report NPS54-82-008. Monterey, CA, Naval Postgraduate School, 1982.
6. Bohn D, Schmitz E: Waiver Policy and Attrition. Technical report 96-01. Arlington, VA, Navy Recruiting Command, 1996.
7. Plag JA, Goffman JM: The prediction of four-year military effectiveness from characteristics of naval recruits. *Milit Med* 1966; 131: 729-35.
8. Vickers RR Jr, Walton-Paxton E, Hervig LK, Conway TL: Stress Reactivity and Attrition in Two Basic Training Populations. Technical report 93-39. San Diego, CA, Naval Health Research Center, 1993.
9. Talcott GW, Haddock CK, Kiesges RC, Lando H, Fiedler E: Prevalence and predictors of discharge in United States Air Force basic military training. *Milit Med* 1999; 164: 269-74.
10. Mittelman M, Bayer J: Total Navy recruit health: making our sailors fit for the fleet. *Milit Med* 1998; 163: 98-101.
11. Larson GE, Booth-Kewley S, Ryan MAK: Predictors of Navy attrition. II. A demonstration of potential usefulness for screening. *Milit Med* 2002; 167: (in press).
12. Hoiberg A, Hysham CJ, Berry NH: Predictors Related to Premature Attrition of Navy Recruits. Technical report 73-48. San Diego, CA, Naval Health Research Center, 1973.
13. Klein S, Hawes-Dawson J, Martin T: Why Recruits Separate Early. Santa Monica, CA, RAND Corporation, 1992.
14. Snoddy RO Jr, Henderson JM: Predictors of basic infantry training success. *Milit Med* 1994; 159: 616-22.
15. Dilsaver SC: Generalized anxiety disorder. *Am Fam Physician* 1989; 39: 137-44.
16. Shioiri TS, Someya T, Murashita J, Takahashi S: The symptom structure of panic disorder: a trial using factor and cluster analysis. *Acta Psychiatr Scand* 1996; 93: 80-6.